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A
THEORY
OF THE
WINDS.

(Price One Shilling.)

BRITISH MUSEUM

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A
THEORY
OF THE
WINDS,

Shewing by a
New *HYPOTHESIS*,
THE
PHYSICAL CAUSES
Of all WINDS in General:
With the Solution of all the VARIETY and
PHÆNOMENA thereof,
As it was read to the ROYAL SOCIETY.

By *BERNARD ANNELY.*

K

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BRITISH MUSEUM

THE PREFACE.

THIS *Diſcourſe was drawn up with an Intent only to be laid before the* Royal Society; *but being finiſhed, I found myſelf under a neceſſity to abridge it in a great Meaſure, to ſuit the Convenience of that Purpoſe; by which I omitted ſome conſiderable Arguments and Illuſtrations. Reflecting then on the Importance of the Diſquiſition, and that an Attempt of this Nature muſt carry the fulleſt and moſt confirming Inſtances* *to ſupport it, I ſaw no other way but to publiſh the compleat Eſſay.*

The Aim and Deſign here purſued, is to prove, that upon Vapours depend the Cauſes of Winds *in common: It will, I preſume, be far from being underſtood, that all the Motions of the Air that are known, muſt proceed from the ſame Principle: For as Air is a yielding Body it may be impreſſed by innumerable Modes of Actions. The flowing of the Sea we are well aſſured is made by the Attraction of the Sun and Moon, but we cannot ſay there are no Motions therein but what are derived from the ſame Source, nor that thoſe Bodies are the only Agents capable of elevating the Waters: For was it thus, we ſhould not ſee the Tides tranſgreſs* *their Theory at any great Wind, by exceeding their proper Height when its Courſe is in Concurrence with them, or be abundantly depreſſed by the Oppoſition thereof.*

There are many Eruptions of Air from Caverns, Pits and Volcano's remarked by Naturaliſts, and likewiſe ſome conſtant and intermitting Breezes which revolve in regular Times, all which it is likely are to be accounted for by peculiar Cauſes: Nor would I ſay, that Heat, which I have taken Notice of in the beginning of this Tract, can have no Effect at all in diſturbing the Atmoſphere: For I am ſenſible, that Air is thereby contracted, or rather, that it loſes part of its Elaſticity, whereby it is preſſed into a narrower Compaſs by that which retains its full

full Spring, which muſt have a Motion as the warmed Air gives way. This is confirmed by many Inſtances, particularly by a Tube whoſe End is immerged in Water, and the other cloſed; if the Air therein be warmed, by putting a Heat near it, or by any other means, the Water will immediately riſe therein; it muſt therefore be deprived of Part of that Elaſticity which before, with an equal Force, reſiſted the Preſſure of the external Air on the Water.

This Effect of Heat, we may obſerve, has been commonly called a Rarefaction of the Air; but I conceive it to be rather a Condenſation; for if Air be contracted into a leſſer Space, it muſt be more denſe and pondrous: Did it dilate itſelf, it would have the contrary Effects to what *we ſee, and muſt expel the cold Air inſtead of drawing it towards it. But I ſhall ſubmit the Property of the Appellation, and according to the Reception of Things, call it, as often as I have occaſion, Rarification.*

We ſee the Reſult of Air always to a Fire, and its Motion is pretty ſtrong through a narrow Hole or Paſſage, to a warm Room, as a ſmall Stream muſt be ſwift to fill a large Evacuation. But this with regard to the Principle of Winds is anſwered in its Place.

The preſent Doctrine of Winds I have eſpouſed as far as it offered itſelf to my Opinion by Reaſons and Probability. The Satisfaction of being informed of the Myſteries and Operations of Nature, was *what actuated me in the Contemplation, and I ſhould eaſily yield to any more certain Suggeſtions towards the Diſcovery.*

The Matter is advanced as an Hypotheſis, which depends on a Species of Reaſoning, whoſe Concluſions cannot be made an abſolute Truth, however they may gain our Judgment. A Probability may be carried to the greateſt Length, and may approach infinitely near, but can never arrive to a Certainty or Demonſtration. Upon this Foundation are moſt Parts of experimental Philoſophy and Phyſicks; in which many things afford us a perfect Aſſurance and Conviction, that we dare not aſſert to be incapable of Contradiction. It is a natural Concluſion, according only to Appearances

pearances and Obſervations, that the Sun is the Centre of the Syſtem of the World, and all the Planets roll, in Orbits round it; but in that View the Tyconic might poſſibly be the true Syſtem, or a Syſtem that ſhould place the Earth perfectly at reſt in the Centre of the Motion, and all the other Part of that Syſtem which now prevails to move round it. This is confirmed to us by all viſible Motions of the Planets, and it would be as impoſſible for us to determine which is the true Syſtem, as if a Man placed at Reſt in the void Univerſe, and a Body moving in a right Line towards him, to know which is in Motion. There is nothing to be argued for the modern Syſtem (laying aſide the Gravitation of Bodies) more than to reflect on the Deſign of the Work, and reconciling it to the Diſpoſition of human

Minds in framing and judging of a Fabrick or Conſtitution: We take it for granted, that the Cauſe that produced the Univerſe muſt have the ſame Underſtanding and Senſes with us; ſuch Motions would not be given as our undefined Judgments determine to be needleſs, or a Uniformity be deſtroyed that ſtrikes the Imagination, which is as great a Myſtery to us as this prepoſterous Syſtem would be.

It is not demonſtrated, that the Planets gravitate to the Sun: There may be a dark inviſible Body to every Planet moving in a correſpondent Orbit that ſhall carry it always in direct Oppoſition to the Planet with relation to the Sun. Theſe ſhall keep each other in their Orbits, by Gravitation, in the ſame manner as the Motions are eſtabliſhed between the

Earth and Moon without any Action of Gravity in the Sun. All Objections of Centripetal Force are removed, becauſe we know not what may be the real Denſity of any of the Planets.

We judge negatively in a Theorick Propoſition. It is proved by ſolving ſuch Difficulties as would contradict any other, which is the removing of what Objections fall in the way. It is therefore true only upon the Suppoſition that there can be no other Objections than what are conſidered, which can never be demonſtrated. The Ptolomaick Syſtem prevailed in the World for many Ages, and Aſtronomers and Philoſophers were well ſatisfied of the Truth thereof, perhaps equal to us of the Copernican and Newtonian Syſtem. That ſubſiſted as long as no Contradictions

tradictions appeared: But when the matchleſs Newton *diſcovered Difficulties of Gravitation and the Laws of Motion, all the former Schemes appeared abſurd and inconſiſtent, which Men of excellent Reaſon and eminent Philoſophers had adhered to.*

If a Subject be copious and produces many Appearances, a Scheme that anſwers them all is remarkable; we reaſonably judge, that when we perceive many Circumſtances, there are the leſs concealed. Thus have we the greateſt Confirmation poſſible of Sir Iſaac Newton'*s Syſtem, becauſe it accounts for ſuch a Variety of Caſes relating to Gravity and Motion. A Myſtery that reveals to us but few Appearances, is hard to be diſcovered: It ſometimes admits of a double Interpretation,*

tation, we therefore depend leſs on the Hypotheſis that ſolves it.

In this Theory I have carefully proceeded to draw natural Concluſions, and have examined all the Phænomena I am acquainted with that concern the Theſis. There are various Obſervations to be made of the Winds, and if a Propoſition could be made fully to explain them all, it would go far toward eſtabliſhing the Diſcovery. It can ſcarcely be attempted to make any Eſtimation of the Winds that happen round the World in the Revolution of a Year, or propoſe any conſtant Motion of the whole Atmoſphere that ſhall be equal to the Summary of its Motions by Winds: We cannot therefore compare the Effects of any conjectured Cauſe that may be computed, to find if it be ſufficient to anſwer for *them. For this Reaſon I have been obliged to ſubmit this Part, with the beſt Helps I can make, to the general Judgment.*

The Enquiry into the Progreſs of Vapours, has led me to take notice of the Productions of ſome other Appearances: I have intimated the Generation of Rain from condenſed Vapours, which has been generally underſtood to fall immediately as ſoon as they were condenſed, or the Bubbles of the Vapours broke; the Riſe of the Humidity of the Air; Winter Fogs, of the Rime in Hoar Froſts, and have mentioned Snow. We might proceed farther upon each of theſe Topicks, but to unravel Particulars would form a Subject to itſelf, and be here an unnatural Digreſſion.

A THEORY OF THE WINDS, &c.

THE *Wind* or Current of the Air is ſo common and familiar a *Phænomenon* in Nature, that a true Knowledge of its *Cauſes* cannot but afford us a grateful Satisfaction. But whatever Speculations have been advanced by many Learned and Ingenious Men, in order to account for the Productions thereof in ſome Meaſure, or for ſome particular *Breezes* or conſtant *Winds*, yet we are at a Loſs to determine from whence do ariſe the Agitations of the Air in general, or to aſſign the *Cauſes* of the violent Motions, and alterable Courſes of it: For the Heat of the *Sun*, which ſome have ſuppoſed to be an Agent herein, by rarifying certain Parts of the *Atmoſphere*, cannot be imagined to produce a *Storm*, or occaſion the ſudden Generation of a great *Wind*: Nor could we expect upon this Suppoſition the ſame *Winds* in the Night, when the Sun is abſent, as the Day; or that there ſhould be any *Winds* in thoſe great Latitudes of the Earth, where, in the Winter, there is ſcarce a ſenſible difference of the Sun's Heat in the Day, more than in the Night; whereas there are more

Winds found to be in theſe Parts than in hotter Climates, and are greateſt in the Winter. Beſides theſe are many other Objections that ſubvert the Probability of this *Riſe* of *Winds*.

To trace out the *Cauſes* of this *Meteor* by Effects and *Phænomena*, we may obſerve, that it is generally attended with a cloudy Sky, and that there are more *Winds* in the Winter, when there is more Rain and obſcure Weather, than in the Summer, and likewiſe in our Northerly Climates than in leſſer Latitudes that are more uſed to a Fair and Serene *Atmoſphere*; which makes it probable, that the aqueous *Vapours* that are ſuſtained by the Air, from whence come Clouds and Rains, may be the Foundation of

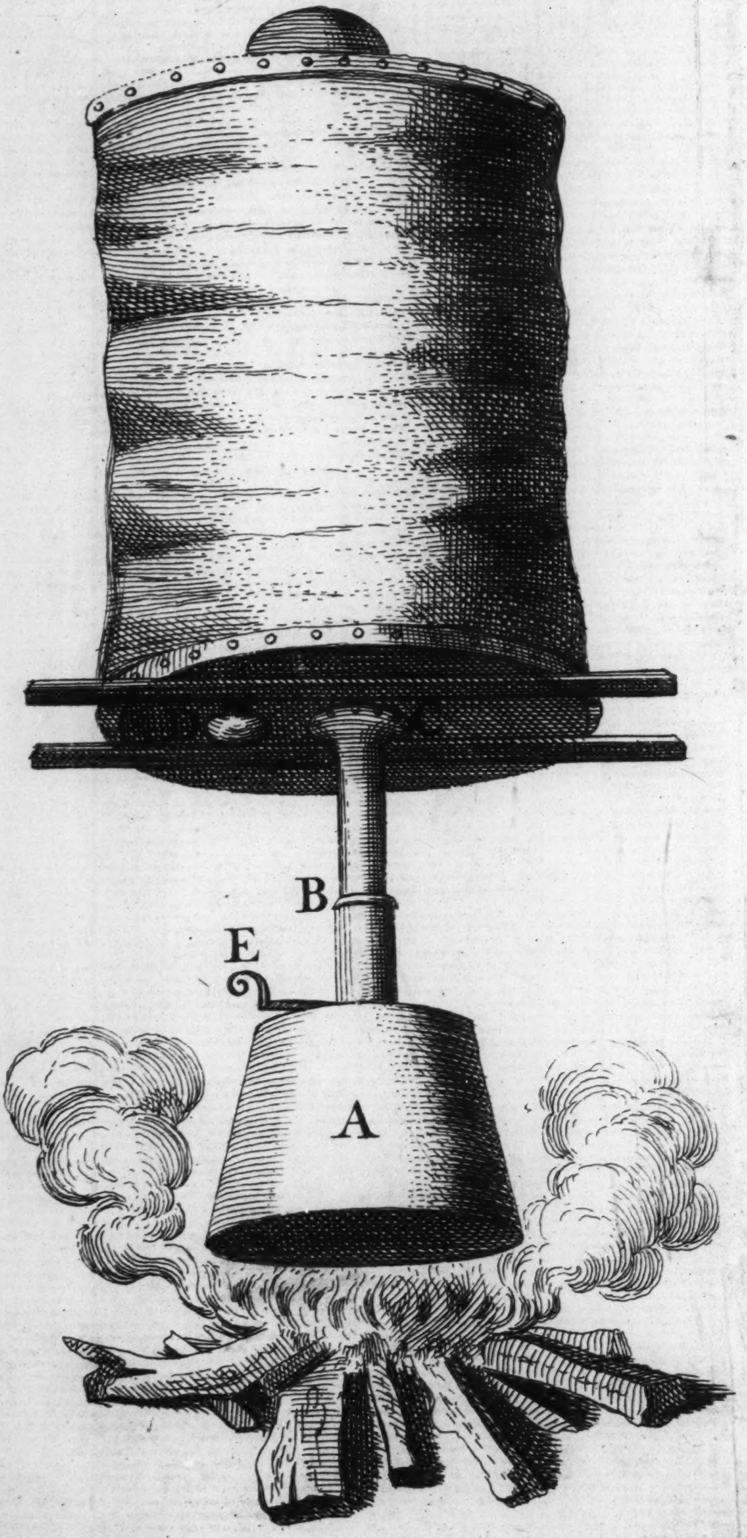
Winds. We ſhall therefore enquire if they may not be owing to the *Exhalaticon* and *Condenſation* of theſe *Vapours*; that is, by the Expulſion of Air from ſome Place, by their *Acceſſion*, or on the other Hand, by the Application of Air, to repleniſh the Evacuations that are made by their Abſolution or *Condenſation*.

It appears paſt all Diſpute, that there is always a vaſt quantity of *Vapours* contained in the *Atmoſphere*, if we conſider how much Water is conſtantly diſcharged from thence in Rain and other Precipitations, and alſo that Curious Eſtimation Dr. *Halley* has given us of the exceeding quantity of Water waſted in *Vapours*, by the Surface of the *Seas* and *Rivers* in the

World, and diffuſed in the *Atmoſphere.*

Now Water is known to have a very great Expanſion in Vapours; ſo that every cubick Inch reduced to Vapours, does exclude as much Air as the quantity of Steam or Vapours it will produce; and on the contrary, if theſe Vapours be exempt of included Air, the Condenſation of what appertains to every cubick Inch of Water, does leave as great a *Vacuum* as is the difference between the Spaces taken up by evaporated and natural Water: But that Vapours are empty, and their Expanſion is not made by Air incloſed in the ſmall Particles which conſtitute them, is evident by thoſe Engines that are contrived for raiſing of Water by means of Steam: For the Condenſation of the Steam or Vapours cauſes a *Vacuum*, which gives room to the Preſſure of the *Atmoſphere*, to act as a Power for working the Machine, of which we have a conſpicuous Specimen in the Engine at *York-Buildings* in *London*.

Nor is it poſſible upon the Principles of Nature that have been hitherto diſcovered, that Vapours could aſcend in the Medium of the Air if their expanded Particles were filled by the ſame Fluid: For then the Weight of the Water, together with that of the included Air, would render each Particle or *Veſicula* ſpecifically heavier than Air of its ſelf, and it muſt of conſequence ſink, unleſs obſtructed by


B
E
A

by ſome Cauſe different from that of Gravity. It is therefore neceſſary that Vapours be exhauſted to acquire a bulk that ſhall make them lighter than Air in order to ſwim therein.

The following Experiment does farther prove, that Vapours are not filled by Air, and likewiſe ſhews the great extent which Water occupies in Vapours.

With two circular Boards of about 10 Inches Diameter, I cauſed a Bellows to be made, which being filled, repreſented a Cylinder $10\frac{1}{2}$ Inches in Height. Over a Hole in the Centre of one of the Boards, I fixed a Pipe of $1\frac{1}{2}$ Inches Diameter; as is ſeen in the *Figure* at *C*. The end of this Pipe ſhuts at *B*, into a Socket belonging to Veſſel *A*, by which means there is made a Communication between the Inſide of the Bellows and of this Veſſel. *D* is a little Pin which being turned round, ſtops the Pipe *C B* by a ſmall Board that moves over it in the Inſide of the Bellows. The Wire *E* in the ſame manner is to ſtop the Socket of the Veſſel *A*.

In the Veſſel I poured a certain quantity of boiling Water, which together with the Veſſel weighed 25 $\frac{1}{4}$ Ounces Troy, and then having compreſſed the Bellows, and brought the two Boards cloſe, I fixed to it the Veſſel, binding ſome Leather faſt over the part at *B* where they joined, to prevent a Communication with the exterior Air. This Veſſel was ſet over a Fire and the Water contained therein, made to boil violently, the Steam whereof did immediately ſwell the Bellows, and in a ſmall time quite filled it. Hereupon I ſtoped the Veſſel, by turning the Wire *E*, and ſeparating it from the Bellows, found it weighed 24 $\frac{1}{2}$ Ounces; that is, it had loſt $\frac{3}{4}$ Ounce of its former Weight. The Content of the Bellows is 824, 25 cubical Inches, but allowing for the Separation of the Boards when compreſſed, which were an Inch diſtant, the Quantity of Vapours therein was but 745, 75 cubical Inches.

The Parts of this *Apparatus* being made ſo cloſe, that no Air could inſinuate itſelf from without, it is certain, that whatever Air was previouſly included in the Veſſel, and Bellows, the Vapours which aroſe from $\frac{3}{4}$ Ounce or 1, 42 cubical Inch of Water, filled 745, 75 Inches without the help of any Air: Beſides the Experiment being repeated and the Bellows filled, it was removed from the Fire to a cool Place, where the Vapours condenſing, the Bellows was depreſſed, by the Weight of the *Atmoſphere*, till quite exhauſted, which could not have happened unleſs the Vapours were devoid of Air; for otherwiſe that which they muſt have emptied would have ſupported the Bellows. We might therefore venture to conclude, that Vapours are made up of ſmall excavated Globules of Water which owe their Inflation only to Heat; and it ſeems confirmed by their Abſolution by Cold.

In this Experiment 1, 42 cubical Inch of Water, filled 745, 75 Inches with Steam; but if we account for what was condenſed on the ſides within the Bellows before the Steam raiſed it to its greateſt Height, the Produce of Steam is much greater. In order to eſtimate it, I made the Experiment once more, and as ſoon as the Bellows was full, immediately ſeparated it from the Veſſel, and forced all the Steam out. I then weighed the Bellows and found it to be 270 Grains heavier than before the Experiment. This ſubſtracted from $\frac{3}{4}$ Ounce or 360 Grains, the Remainder is 90 Grains, which is what was really contained in Vapours within the Bellows. 90 Grains to produce 745, 75 cubical Inches, is after the rate of

1 Inch of Water to fill 2100, 6 Inches of Steam or Vapours, according to the ſpecifick Weight of Water. If this Experiment be defective, it has made the Produce of Steam too little. It has been aſſerted, but by what Experiment I know not, that an Inch of Water makes 13000 Inches of Steam.

All the Water then which falls in Rain, Snow, *&c.* poſſeſſed 2100, 6, or ſay 2000 times the Space when it floated in the Atmoſphere in Vapours; and the Condenſation thereof muſt occaſion Vacuums, which collected would be a Space 2000 times greater than what is taken up by it in Water, which will put the ſurrounding Air in no ſmall Motion to reſtore ſo conſiderable a Deficiency.

And did we know the Quantity of Vapours that were condenſed in a given Time over a known Extent of the Surface of the Earth, we ſhould deduce how great a Rarifaction was made in that Time in the Atmoſphere, and thereby be able to eſtimate the Celerity of the circum-adjacent Air, or how great a *Wind* was generated in all the Parts round that Place.

It is not at all improbable, that there is often aſſembled in the Atmoſphere, a ſufficient Quantity of Vapours to maintain a laſting Condenſation, and that it is alſo quick enough at ſome times to create a great *Wind:* For ſome Rains we are accuſtomed to, are ſufficient to make a ſmall Motion of the

Air, were the Vapours to condenſe no faſter than the abſolved Particles diſcharge themſelves by that Means; but it ſeems very evident to be much faſter; for when any Part of the congregated Body of Vapours arrive to a ſtate of Coldneſs fit to condenſe them, it will be ſuppoſed the Condenſation does quickly ſpread it ſelf throughout the whole miſty Region. How it is that the aqueous Atoms are not precipitated immediately upon their Converſion from Vapours, is thus. Vapours being detached from Water in ſome warm Climate, they aſcend in the Air till they acquire a certain Height where they are ſuſpended, by their ſpecifick Gravity, and the Viſcouſneſs of the cold Air in thoſe ſuperior Parts of the Atmoſphere that are remote from the

Reflection of the Earth. Here they remain till, by the Accumulation of two contrary Winds meeting at that Place, they are farther raiſed to a Region cold enough to condenſe them; or elſe they are removed, by a Current of the Air, to ſome cold Parts or Climates of the Earth where they are condenſed. The Particles of Vapours being abſolved into Particles of Water, they become exceedingly leſs, and are unable to overcome the Coheſion of the Parts of the Air for to deſcend: For tho' Water is exceedingly greater in its ſpecifick Weight than Air, and Air is more rarified the greater is its diſtance from the Earth; yet it has been ſhewn by Mr. *Mollyneux* to the *Royal Society*, that there is ſo great a Power of Union between the Parts of ſome

Liquids, as to ſuſpend diſſolved Bodies that are far heavier, and that *Mercury* will ſwim in Spirits of *Nitre*: For the coheſive Power of the Liquid is to be conſidered according to the Surface of the ſuſpended Body, and the Gravity acting againſt it, as the Body's Solidity; and there being a leſſer Proportion in the Decreaſe of Bodies in their Surface than in their Bulk, a Body may be of that Minuteneſs, as to ſwim in the moſt ſubtle Fluid that has any determinate Coheſion.

Air is known to be a tenacious Fluid, and there is a greater Coheſion in its Parts the more frigid it is; the Atoms which proceed from Vapours are alſo infinitely ſmall, for they are imperceptible while inflated Bubbles in

Vapours, and being reduced to Water are 2000 times leſs according to our Computation. There is therefore no room to doubt, but that Vapours may be retained in the Air ſome time after their Condenſation.

And it ſeems confirmed by Obſervation: For we may aſcribe to theſe unprecipitated Atoms of Water, the Humidity of the Air, and that very moiſt and thick Weather that we ſometimes have, when the floating Atoms roving up and down by the Agitations of the Air, alights on our Walls, Floors, Windows, and ſuch like Places; which we find very frequently in the Winter Seaſons, eſpecially in the Night; for the extraordinary Cold thereof does in a great Meaſure condenſe thoſe Vapours that are raiſed by the Sun and Wind in the preceding Day, which for want of Time, or by the Reſiſtance of the cold Air, are prevented from riſing high; wherefore we ſee the Glaſs of Windows covered by Miſts, at leaſt on the Inſide, for the Wind dries the Outſide as faſt as they gather.

To this is owing the Dilatation and Contraction of the *Hygrometer*, the Water imbibed by calcined *Salt-petre*, and alſo the Dews of the Summer, which are derived from the Vapours extracted by the intenſe Heat of the Day, and condenſed in the Night.

In the Winter when the Air is diſpoſed for freezing, it is not unlikely, that the Atoms that harbour next the

Earth are congealed, whereby they become more opake, and conſtitutes thoſe obſcure Fogs which always attend a hoar Froſt; and it is confirmed by the Rime, which I take to be theſe frozen Atoms diſperſing themſelves in the ſame manner as the humid. They no doubt are alſo in the higher Parts of the Atmoſphere; and it is not abſurd to think, that upon them depends the Generation of *Snow*.

But the condenſed Vapours are very copious on the Tops of high Hills and Mountains, which extend themſelves to the Clouds, or to the Regions where the Vapours exhaled by the Earth do chiefly reſide. This Dr. *Halley*, in his *Account of Vapours*, has given us an Inſtance, who found Miſts to gather exceeding faſt on the Hills of St. *Helena*. Vapours then ſtill ſwimming in the Air after their Condenſation, I ſuppoſe they remain till by the Alteration of the ſtate of the Atmoſphere, or by their Tranſpoſition by Winds, they become more accumulated, and the Atoms approach each other ſo near as to incorporate, whereby having acquired a ſize large enough to overcome the Tenacity of the Air, they deſcend, and in their way perhaps meet many others which add to their Bulk, till at length they fall to the Earth in Drops of Rain faſter or ſlower. When they are of a Quantity, and in a condition to concrete very faſt, they make a great Rain, otherwiſe it is in a ſlow or moderate Degree.

Hence we might obſerve, that there is a Diſtinction to be underſtood with reſpect to Vapours, between Condenſation and Concretion: Condenſation is the Diſſolution of the ſmall Bubbles or *Veſiculæ*; Concretion is the uniting of the Atoms after Condenſation.

Since therefore we are not to compute the Condenſation of Vapours by any Rain that falls, but may believe they can be condenſed quick enough to cauſe a *Wind* of any Intenſity; we are next to enquire, whether the Earth do not ſupply the Atmoſphere with ſufficient Quantities of Vapours to account for all the *Winds* throughout the World.

This will not appear a Difficulty, if we attentively conſider the Quantities emptied in Rain, Snow, Hail, *&c.* and what a great Part of the aqueous Load of the Atmoſphere is never precipitated this way, but ſpent in a ſort of Dew before the condenſed Miſts or Clouds are prepared for Rain, or any other Precipitation, which is received in ſo great a Meaſure by high Land and Ridges, that Dr. *Halley* aſcribes to it the Riſe of Springs, of great Currents, the Repletion of Seas, *&c.* We may likewiſe judge by the Barometer of the Vapours ſuſtained by the Atmoſphere, which ſometimes in a ſenſible Meaſure augments the Weight thereof. This is a very conſiderable Proof if we conſider farther, that at the loweſt Degree of the *Mercury*, the Atmoſphere is without doubt much heavier than if it was a pure homogeneous Fluid.

But to adhere only to the Eſtimation Dr. *Halley* has given us of the Vapours raiſed by the Heat of the Sun, we ſhall find an immenſe Quantity is conſtantly remitted from the Earth to the Atmoſphere: For according to an Experiment made by him, a Heat equal to that of our Air in a hot Summer (which may be taken for a mean Heat of the Sun with regard to the whole Earth) extracts 33 Millions of Tons of Water every Day in Vapours from a ſquare Degree. Suppoſe $\frac{3}{4}$ of the Surface of the Globe to conſiſt in Seas, Rivers, and other Waters,

ters, which is not too great a Proportion as far as we have a Knowledge of it: The Circumference is 360 Degrees, and 4 times the Area of that Circumference or Circle is the Area of its Superficies 11314,9 ſquare Degrees: $\frac{3}{4}$ of this is 8486,175 Degrees the Area of the Waters, which multiplied by 33 Millions, gives 285 Thouſand and 43 Millions, 775 thouſand Tons of Water drawn from the Surface of the Earth in one Day. This will fill 64,781 cubical Miles, which being multiplied by 2000, is 129861 Miles, the Space it will take up in Vapours, from whence ſubſtract 64,781, the Remainder is 129796,219 cubical Miles of the Atmoſphere filled by Vapours every Day.

This prodigious Quantity being divided and aranged in Bodies at various Situations throughout the World, occaſions by the mutual Condenſations, almoſt conſtant Reſults of the Air to ſupply the empty Places, and I believe it will be thought abundantly ſufficient for producing and maintaining all *Winds* univerſally, eſpecially if we conſider with Dr. *Halley*, what unknown Quantities of Vapours are raiſed by the *Winds*, and likewiſe, that the great and variable *Winds* do not extend all over the World, but ſeem rather confined only to thoſe Quarters towards the *Poles*: For in thoſe Countries which approach the *Æquator*, there is known to be generally a hot ſettled Air, and the Winds (whenever they are favoured with them) are no more than ſlow Breezes. As for the inceſſant Current of the trade *Winds*, they are a peculiar Conſideration; and ſeem to be built on other Principles than the Condenſation of Vapours.

And becauſe the Circles of the Earth decreaſe as they advance in Latitude, theſe Spaces where the *Winds* are chiefly ſeated, contain but a ſmall Portion of the whole Atmoſphere, and therefore a leſs Quantity of Vapours is required to ſupply them.

Thus far have we treated of what relates to the Condenſation of Vapours; but it will be ſuppoſed, that upon the ſame *Hypotheſis*, their Acceſſion to the Atmoſphere will alſo cauſe a Motion therein by driving the Air from the Place they occupy. Herein we are to obſerve, that the Evaporations of the Earth are unbounded throughout the Hemiſphere next the Sun, and what Vapours occur to any one Place, do every where reſiſt the Incurſion of the ampulated Air from the neighbouring Place; and tho' the Earth do more profuſely emit its Vapours where it is in the vertical Heat of the Sun, yet the Air by the greater Heat there, is more rarified, whereby it makes room for admitting a greater Quantity of Vapours; and ſo if we proceed from the *Zenith* to the *Horizon*, we ſhall find, that as the Emiſſion of Vapours decreaſes according to the Heat of the Sun, it ſupplies the Rarification which decreaſes in the ſame manner. Thus the Air of that ſide of the Earth towards the Sun, is oppoſed from flowing in on the contrary Hemiſphere, by the augmented Reſiſtance the latter receives by being condenſed by the Cold of the Sun's Abſence.

But conſidering how great is the Expanſion of Vapours, and that they are emitted inceſſantly, we may believe they do more than balance the Rarifaction made by the Sun's Heat, and ſwelling the Atmoſphere occaſions a Motion to the attenuated Parts, and has frequent Recourſes to Land which produces leſs Vapours; whence it is likely thoſe Breezes come which are felt on Shores open to the Seas, and have the name given them of *Sea Breezes*.

There are alſo the reverſe of theſe Winds which we might enquire into, that blow from the Land, and are known to Seamen at their approaching it, by whom they are called *Land Breezes*. Theſe may poſſibly proceed from the extraordinary Heat of the Sun, by the Reflection of the Soil, which cauſes the Sea that is next the Land to evaporate more copiouſly than do the remote Ocean, which is uncapable of ſuch a Reflection. Hereby the Air is driven towards the Sea to reſtore an Equilibrium. But to undertake the perfect Solution of theſe *Phenomena*, it is neceſſary to be acquainted with the Situation of the Country, how it is laid out in Lands and Rivers, and the Texture of the

Soil both for Reflection and Evaporation.

From hence therefore the Production of Winds depend chiefly on the Condenſation of Vapours. We ſhall proceed to explain the ſeveral Properties and Caſes that are ſolvable thereby, which is not only what is requiſite, but will alſo be a Confirmation to the *Hypotheſis*.

1. The Direction or Courſe of any Wind, is according to the Situation of the Body of Vapours, whoſe Condenſation produces it; ſo if a Concourſe of Vapours be gathered over the Kingdom of *France*, the Condenſation thereof would draw the Air from *England* in a Southerly Direction, in *Spain*

Spain would be a Northerly Wind, in *Germany* it would blow Weſterly, at the *Bay* of *Biſcay* an Eaſterly Wind. And when this Condenſation is extinct, ſhould another fall out over *Norway*, the Southerly Wind in *England* would be changed into a North-Weſt, the Wind in *Germany* to Northerly, and ſo in the other Countries as they are poſited. The Courſe of a Wind may alſo proceed from a compound Cauſe, as there may be a Condenſation over *France* and *Norway* at the ſame time, which would make a South-Eaſterly Wind in *England*.

2. The Force or Intenſity of a Wind is as the Extenſion of the condenſing Vapours, and the Quickneſs of their Condenſation. A Wind is alſo en-

encreaſed by a Compoſition of Condenſations in divers Parts, it being acted upon by each; ſome Circumſtances in which may create an extraordinary Celerity of the Air: As for Inſtance; at a Place that is between any two Condenſations, the Air is doubly attenuated by a double Action, and the Reſult of other Air to ſupply this at the Avenues to it, will be much greater than what flows to the Condenſations themſelves. Theſe Things being duly examined, with the poſſible Quickneſs of Condenſation, and the Concurrence of riſing Vapours, we might venture to proceed to the Caſe of a *Hurricane*.

3. How it comes to paſs, that there are more *Winds* about the *Æquinoxes*

quinoxes than at other Seaſons, may ariſe from this: The Sun at thoſe Times being in the Æquinoctial, it paſſes over a greater Circle of the Earth than at any time before or after, when it is declined to the Tropicks, and by its vertical Heat, does raiſe a greater Quantity of Vapours, the Condenſation whereof muſt produce the more Winds. It is likewiſe probable, that at the *Æquator* the Sun's Heat is more retained than in all other Places of the Globe; for its Receſs is leaſt from that Circle, and it croſſes it twice every Year; ſo that at its approaching there is a greater Evaporation made than if the Climate, by a long Abſence, muſt be acted upon ſome time before it arrives to its greateſt Degree of Heat, in which the Waters are moſt volatile.

4. It is underſtood, that the greater Quantities of Rain that fall in the Winter, muſt occaſion more Winds than in the Summer there being a proportionable Quantity of Vapours condenſed; and likewiſe,

5. That there are more Winds in diſtant Latitudes than towards the *Æquator*, becauſe the former are more ſubject to Rains.

But we ſhall beg leave to make a ſmall Digreſſion to enquire into the particular Reaſons of ſome paradoxical *Phænomena* in theſe two laſt Caſes, which requiring the help of ſome new

Theory may be a Confirmation to this; that is,

6. Why there is more Rain and Wind in the Winter than in the Summer; when the Heat of the Sun in the former is more weak and languid, by which it is incapable of raiſing any great Quantity of Vapours to produce that Rain and Wind.

In the Solution hereof, it is to be obſerved, that the Quantity of Vapours extracted from the whole Earth by the Sun, is the ſame in the Winter as in the Summer; for if at any Place the Sun's Heat is diminiſhed, it is as much increaſed with the *Antiœci* of that Place. The Exhalations of Vapours grow leſs according to the Heat of the Sun, which is proportionable to the Latitude. The Vapours then that are raiſed in the greateſt Plenty about the *Æquator*, or between the Tropicks, being forced from their Places, by the continual Acceſſion of new Vapours, to the leſs crouded Parts towards the Poles, are condenſed upon their Arrival at thoſe diſtant Climates which retain a ſtate of Coldneſs ſufficient for that Purpoſe. They are alſo carried by the Winds that enſue upon theſe Condenſations. But the cold Temperature of the Air of that Side the *Æquator* where it is Winter condenſes the Vapours very plentifully, and conſequently there are more do fly with the Current of the Air to ſupply theſe than to the oppoſite ſide of the World where the Summer reigns, the Heat whereof diſſipates the Coldneſs neceſſary for condenſing of Vapours. If there be a greater Quantity of Vapours condenſed, there muſt be the greater quantity Rain and Wind, which holds reciprocally between the Winters and Summers of each Side the *Æquator*.

From hence we perceive,

6. Why we have more Rain and Wind towards the Poles than about the *Æquator*, altho' the latter is a part of the World where the Sun makes the greateſt Evaporations.

I doubt not but there may be many other Circumſtances than theſe relating to the Winds; ſome that are remarkable and peculiar in various

Countries and Situations of the Earth, which has eſcaped the Notice of any publiſhed Relations or Hiſtory; a compleat Account hereof might perhaps furniſh us with Inſtances enough to confirm this Theory paſt all Conteſt. It would therefore be worthy of a curious Mind, that is well informed herein, to try the Solution of any farther Phænomena upon the Hypotheſis, in order to eſtabliſh a Matter which will further our Diſcoveries a conſiderable ſtep in the Progreſs of Nature; we may be thereby ſatisfied of the Cauſes of a Meteor, that has ſubſiſted in equal Duration with the World, and we may believe, has been as long a Secret.

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